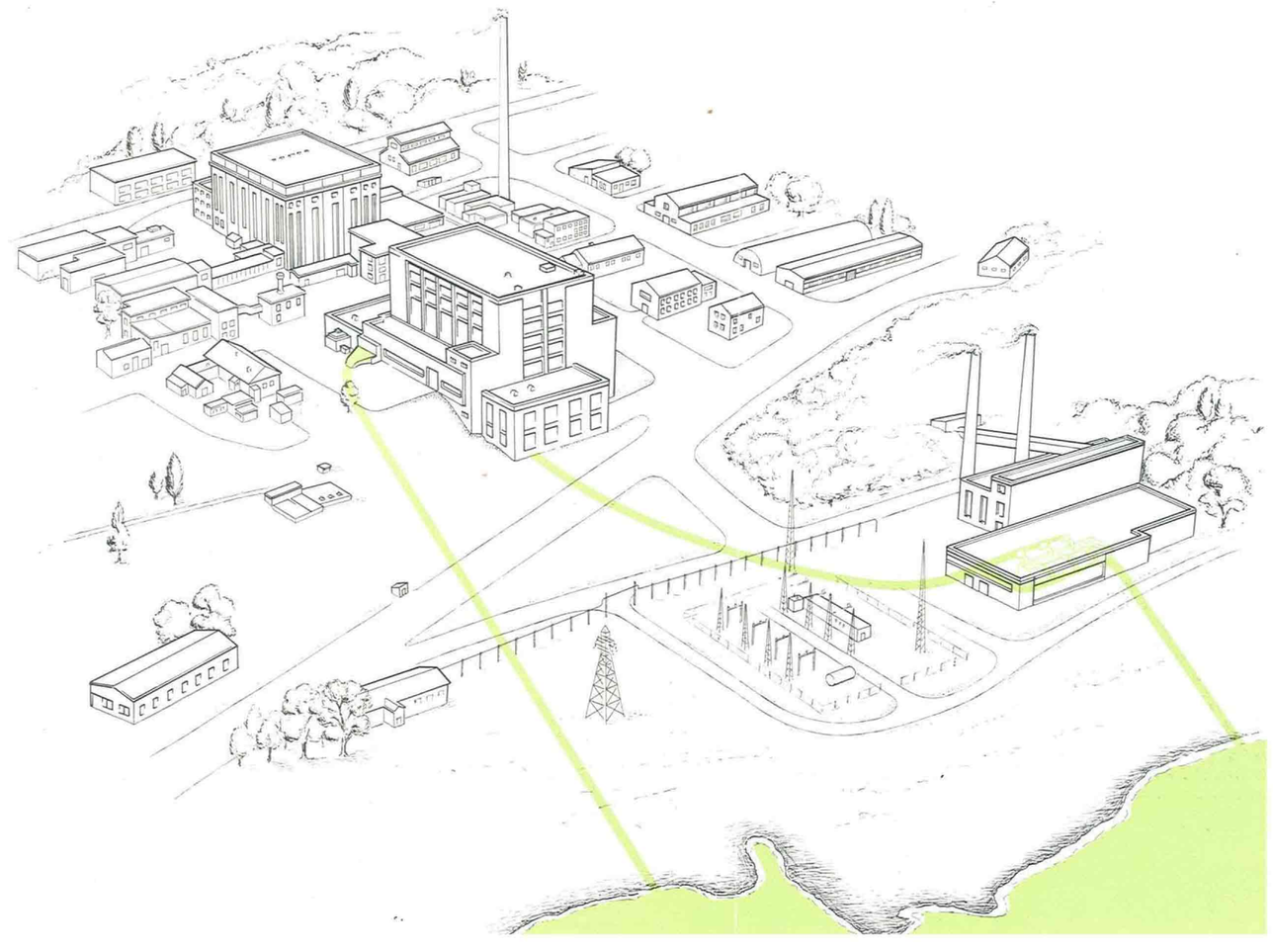
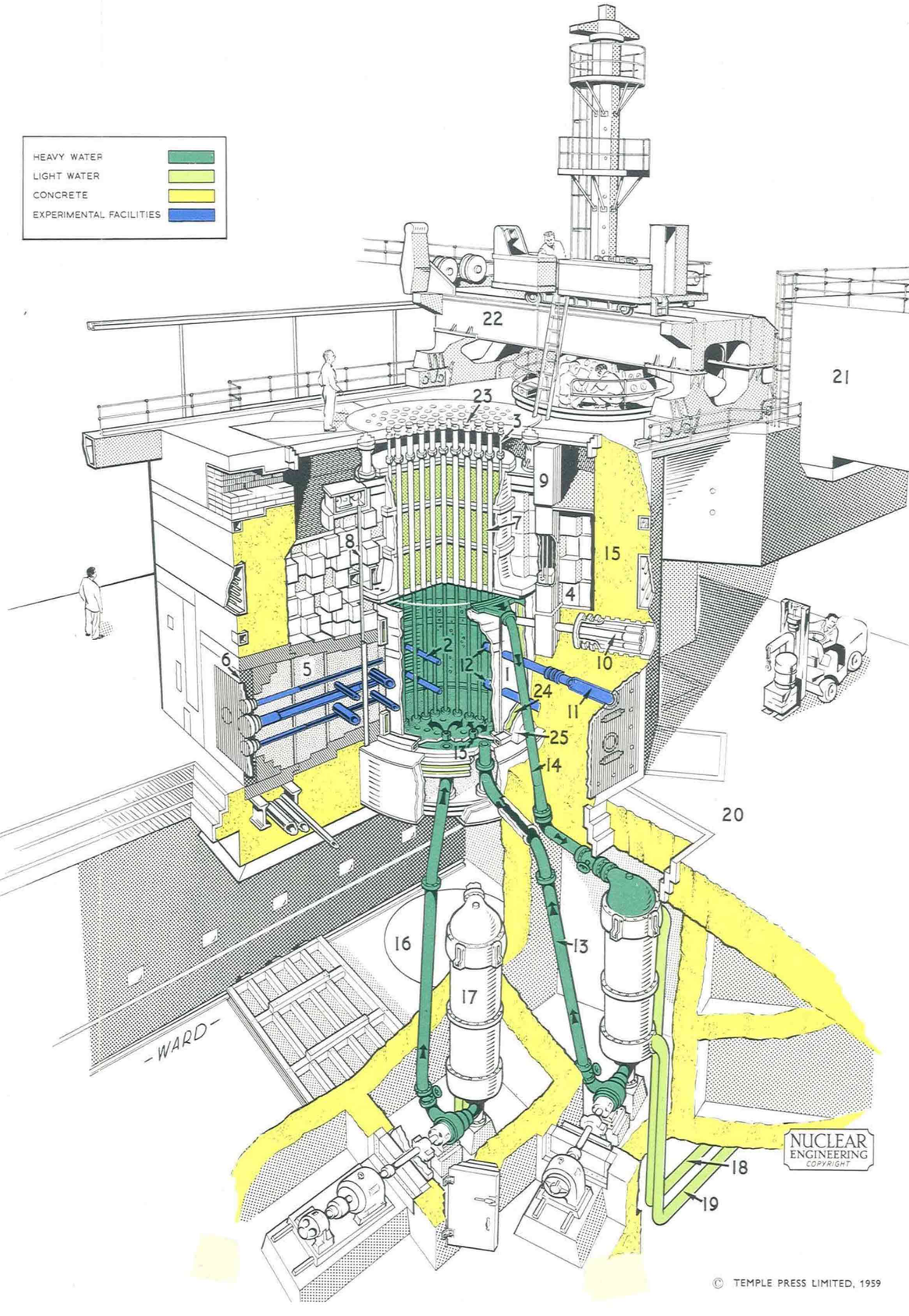
The World's Reactors

No. 20 NRU

KEY

1. Calandria wall
2. Calandria through tube
3. J-rod
4. Movable blocks of concrete
5. Graphite thermal column
6. Lead door
7. Light water
8. Shutter
9. Gate operating mechanism for experimental hole
10. Ion chamber
11. Experimental hole
12. Re-entrant cans
13. Heavy water inlet
14. Heavy water outlet
15. Concrete biological shield
16. Calandria disposal pit
17. Heat exchanger
18. River water outlet
19. River water inlet
20. Main floor
21. Shielded room
22. Isotope rod flask
23. Fuel rod
24. Light water reflector
25. Steel thermal shield





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The World's Reactors

No. 20 NRU

TYPE: Thermal heterogeneous.

PURPOSE: Research and materials testing; isotope production.

LOCATION: Chalk River, Canada.

OWNER: Atomic Energy of Canada, Ltd.

OPERATION: Criticality achieved November 3, 1957.

RATING: 200 MW.

CORE: Approximately hexagonal, 11 ft 6 in. diameter.
Active length 10 ft.
Lattice centre $7\frac{3}{4}$ in. 218 holes.

FUEL: Natural uranium.
Total investment approx. 12.5 U.S. tons.

FUEL ELEMENTS: Five flat strips of aluminium-clad uranium enclosed in aluminium tube.
Width of central strip 5.446 cm.
Width of intermediate strips 4.983 cm.
Width of outer strips 3.109 cm.
All strips 305 cm (10 ft) long.
Thickness of strip 0.434 cm.
Thickness of cladding 0.063 cm.
Total weight of U per element 120 lb.

MODERATOR: Heavy water.
Total investment 58 tonnes.

FLUX: Peak (at core centre) 200 MW: 2.5×10^{14} n/cm² sec.

CONTROL: 16 stainless steel tubes (13 cadmium, 3 cobalt).
Diameter $3\frac{1}{2}$ in.
Length 10 ft.
Rods grouped in banks of 4, 4, 8.
Reactivity controlled by 4-rod banks 0.036.
Reactivity controlled by 8-rod bank 0.074.
All rods dropped simultaneously for scram shut-down.

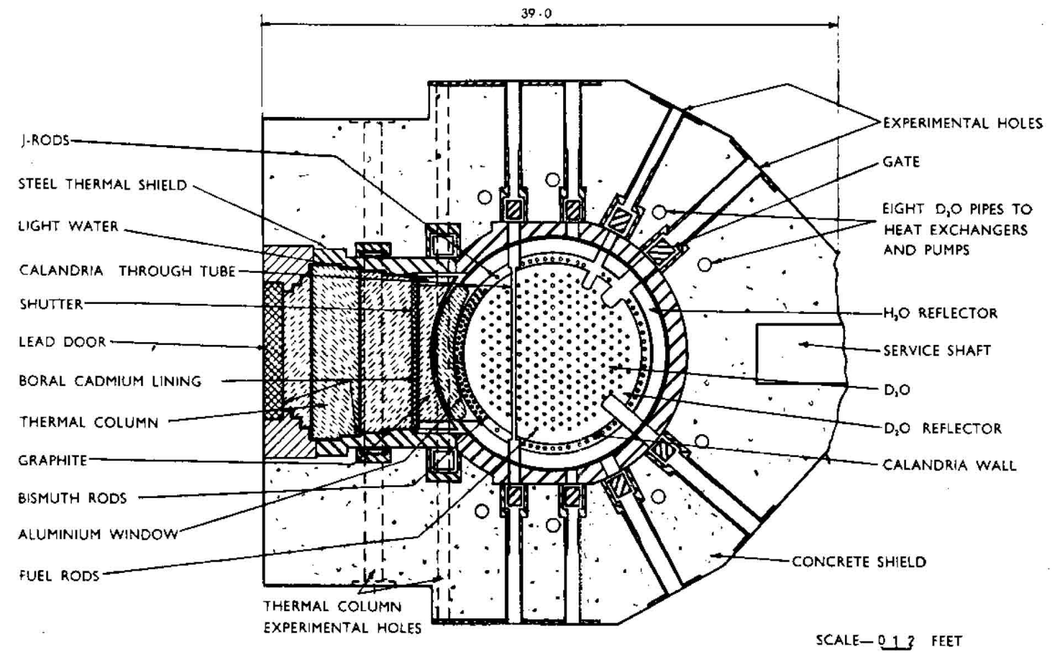
COOLANT: Heavy water circulated through 8 heat exchangers indirectly cooled by a distilled water circuit, secondary heat exchangers being cooled by river water.

Inlet temperature of D_2O	120°F (49°C)
Outlet temperature of D_2O	167°F (75°C)
Max. coolant velocity in core	33 ft/sec
Water circulation	22,000 gal/min (100,000 litres/min)
Maximum heat transfer at 200 MW	630,000 B.t.u./ft², h (199 W/cm²)
Maximum surface temperature	215°F (102°C)
Maximum uranium temperature	370°F (193°C)
Natural water through main heat exchangers	20,000 gal/min (91,000 litres/min)

CALANDRIA:

Inside height (between header blocks)	12 ft (3.66 m)
Inside diameter of reactor	11 ft 6 in. (3.51 m)
Width of J-rod annulus	6 in. (0.15 m)
Inside diameter of water reflector	12 ft 6 in. (3.81 m)
Outside diameter of water reflector	14 ft $8\frac{1}{4}$ in. (4.48 m)

SHIELDING: Thermal shielding: 12 in. thick cast steel, water cooled.
Concrete shielding 9 ft 6 in. thick using ilmenite ore and magnetite sand.
Density of concrete about 220 lb/ft³.



Sectional plan of reactor. Note slight displacement of core lattice where the horizontal facility passes through.

EXPERIMENTAL FACILITIES: 27 horizontal facilities through the shielding some 12 in., some 6 in. diameter. Beam holes provided with cooled gate just outside thermal shield.
Thermal column 8 ft sq. at inner end, 10 ft at outer.

ESTIMATED NEUTRON BALANCE:

$\eta_f = 1.326$
$\varepsilon = 1.017$
$p = 0.912$
$f = 0.955$
k_∞ at 20°C $= 1.175$
$L^2 = 0.0147$ m²
$L_s^2 = 0.0127$ m²
$B = 3.28$ m^{-2}*

Escape Loss	−0.085
Temperature Correction	−0.009
Samarium Capture	−0.006
Xenon Capture	−0.029
	1.046
Available Surplus	0.046

*B is the geometrical buckling including effects of vacant positions for control shut-off rods, the split in the lattice and re-entrant cans for experimental beam holes.

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